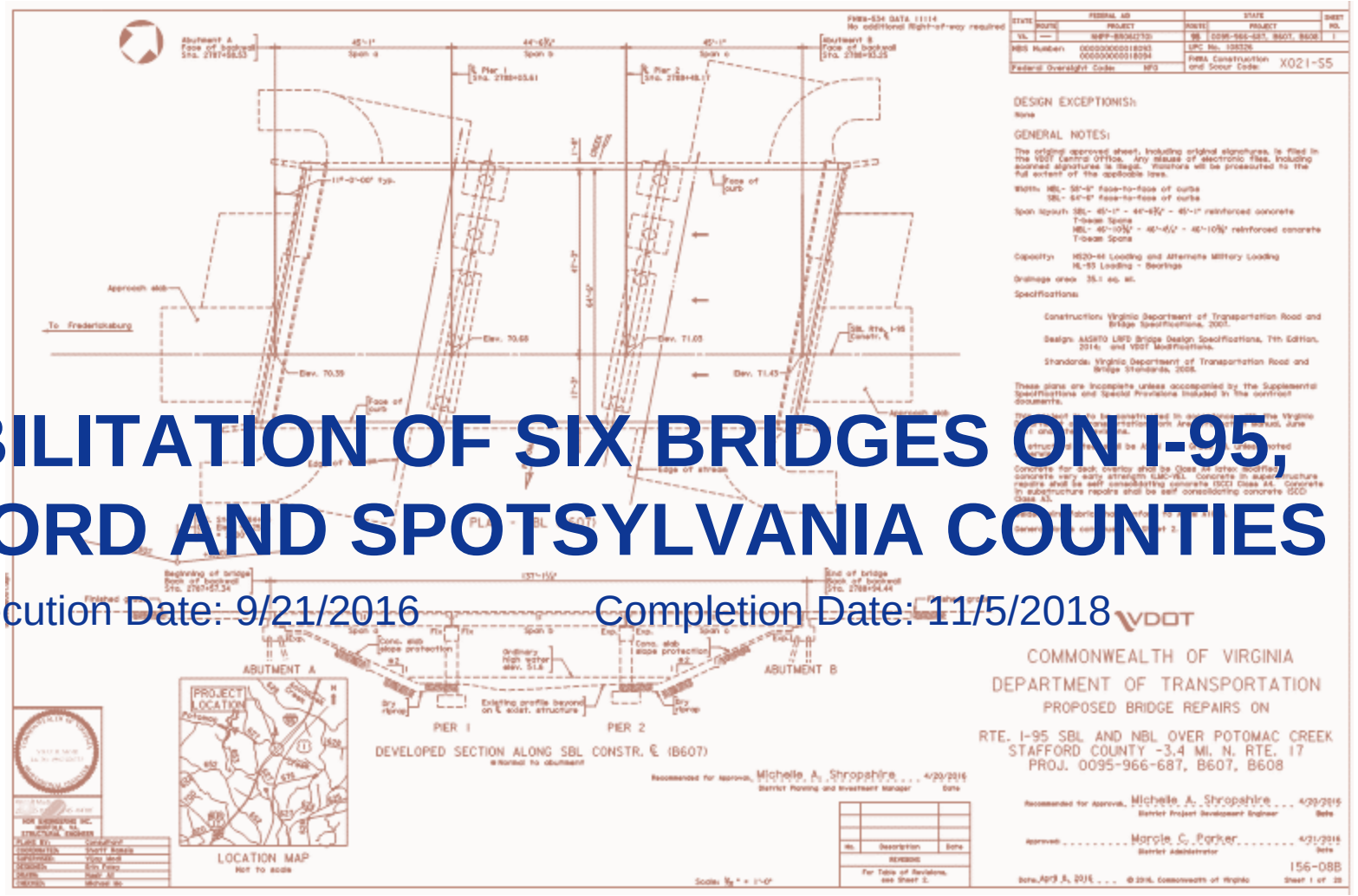

VDOT
Virginia Department of Transportation

REHABILITATION OF SIX BRIDGES ON I-95, STAFFORD AND SPOTSYLVANIA COUNTIES



Contract Execution Date: 9/21/2016 Completion Date: 11/5/2018

Sharif Ramsis, PhD, PE and Annette Adams, PE

March 1st, 2019

I95 SBL over Potomac Cr. – Pier 2 Col.1(E)

I95 NBL over Ni River – Pier 2 joint closure, East shoulder

I95 SBL over Ni River – Pier 2 Jacking-Blocking

I95 SBL over Ni River – Bay 6 looking North

I95 SBL over Ni River - Deck surface looking West

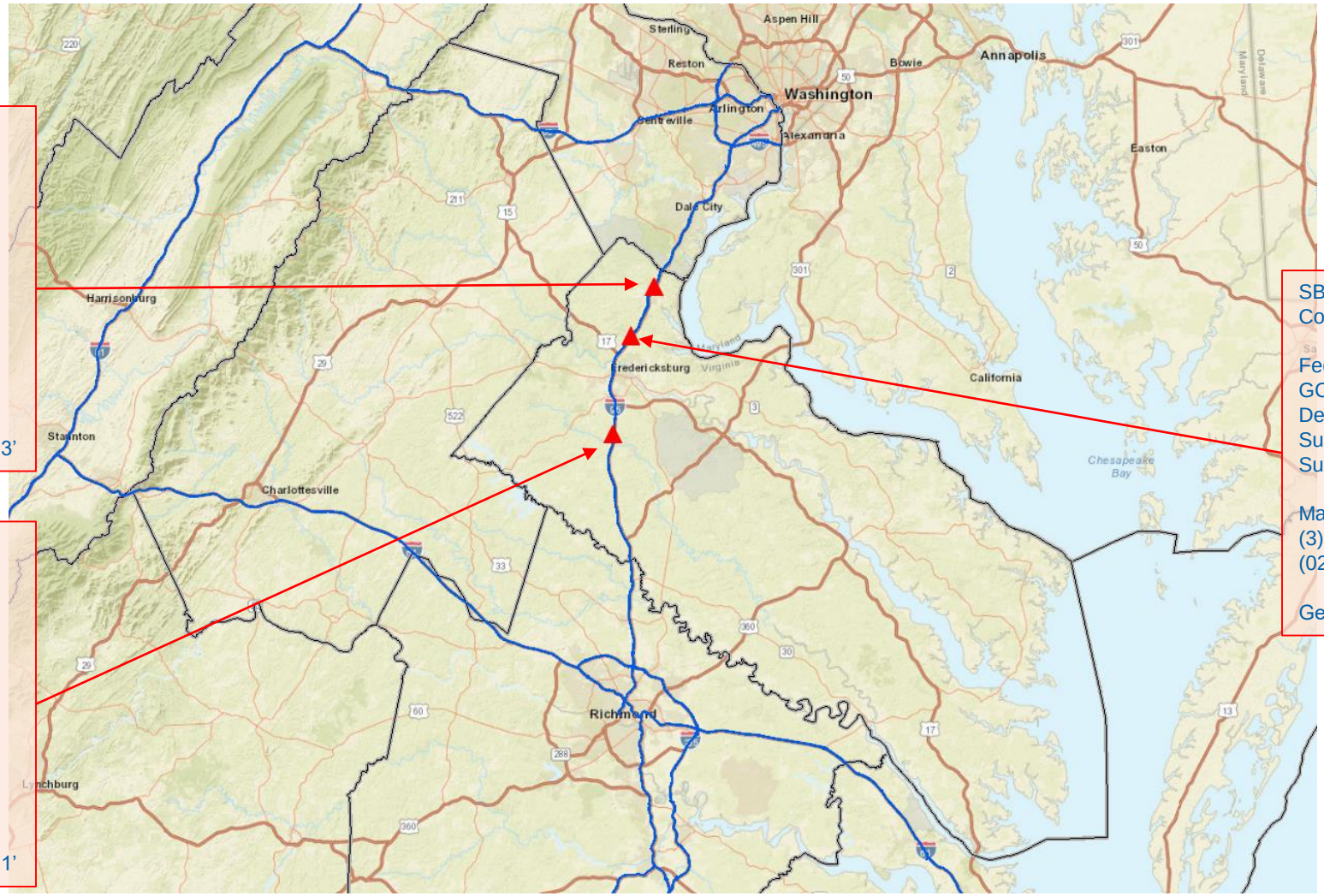
Bridges location

SBL and NBL Route 95 over Aquia Creek
County: (089) Stafford

	SBL	NBL
Fed.Str.ID	18091	18092
GCR (2015):		
Deck	6	6
Superstructure	5	5
Substructure	6	6
Materials:		
(3)	Steel	Steel
(02) Stringer/Multi-beam or Girder		
Geometry:	159.33'x67.83'	159.33'x67.83'

SBL and NBL Route 95 over Ni River
County: (088) Spotsylvania

	SBL	NBL
Fed.Str.ID	17941	17942
GCR (2015):		
Deck	5	5
Superstructure	6	5
Substructure	6	6
Materials:		
(3)	Concrete	Concrete
(02) Tee-beam		
Geometry:	108.12'x67.91'	108.12'x67.91'



SBL and NBL Route 95 over Potomac Creek
County: (089) Stafford

	SBL	NBL
Fed.Str.ID	18093	18094
GCR (2015):		
Deck	6	6
Superstructure	5	5
Substructure	5	5
Materials:		
(3)	Concrete	Concrete
(02) Tee-beam		
Geometry:	137.11'x67.83'	142.46'x61.83'

Preventive Maintenance Constraints - 1

SBL and NBL Route 95 over Aquia Creek
County: (089) Stafford

	SBL	NBL
1.Traffic: AADT (2015)	71,000	71,000

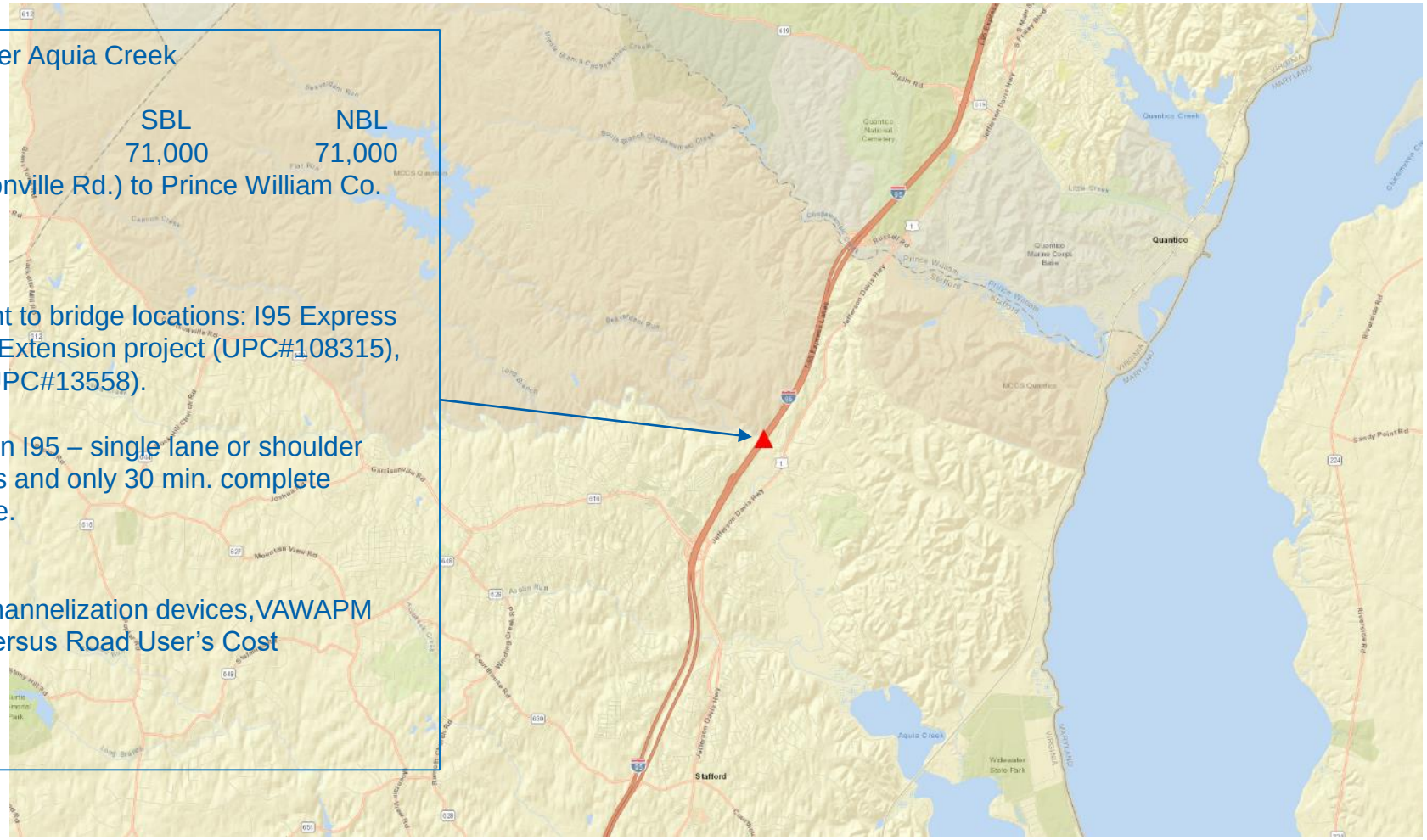
Between Rte. 610 (Garrisonville Rd.) to Prince William Co. Line
Exit 143 to Exit 148

2.Active Contracts adjacent to bridge locations: I95 Express Lanes Southern Terminus Extension project (UPC#108315), 630 Interchange project (UPC#13558).

3.Limitation of Operation on I95 – single lane or shoulder closures, two lane closures and only 30 min. complete closure on limited schedule.

4.Maintenance of Traffic
-Drop off/use of barriers,channelization devices,VAWAPM
-Shoulder strengthening versus Road User's Cost
-Steel bridging plates

5.Budget constraints



Preventive Maintenance Constraints - 2

SBL and NBL Route 95 over Potomac Creek
County: (089) Stafford

	SBL	NBL
1.Traffic: AADT (2015)	65,000	67,000

Rte. 8900 (Centreport Pkwy.) to Rte. 630 (Courthouse Rd.)
Exit 136 to Exit 140

2.Active Contracts adjacent to bridge locations: I95 Express Lanes Southern Terminus Extension project (UPC#108315), 630 Interchange project (UPC#13558), Pavement work on I-95 and Rte.1.

3.Limitation of Operation on I95 – single lane or shoulder closures, two lane closures and only 30 min. complete closure on limited schedule.

4.Maintenance of Traffic
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-Shoulder strengthening versus Road User's Cost
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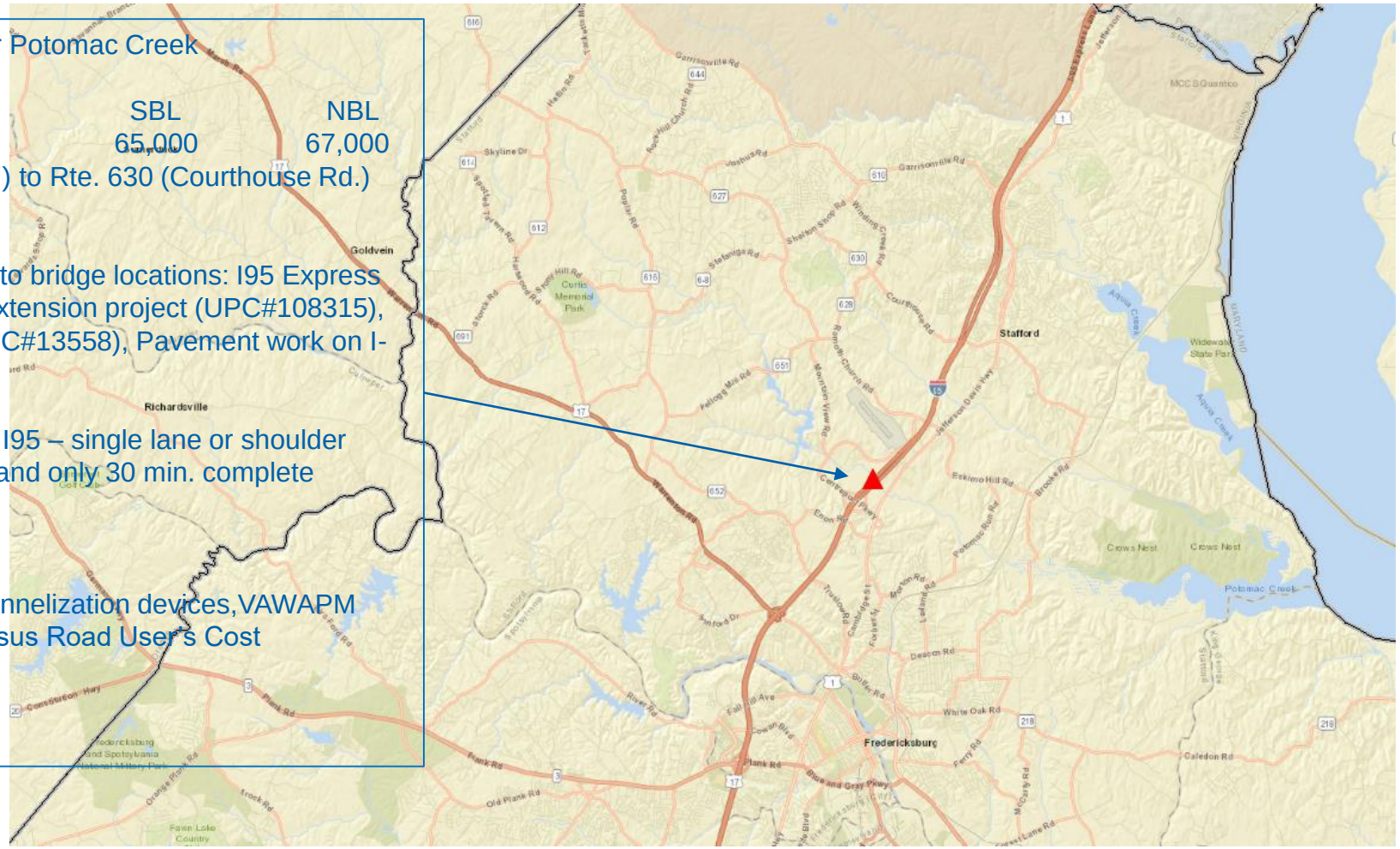
5.Budget constraints



Preventive Maintenance Constraints - 3

SBL and NBL Route 95 over Ni River
County: (088) Spotsylvania

	SBL	NBL
1.Traffic: AADT (2015)	49,000	49,000

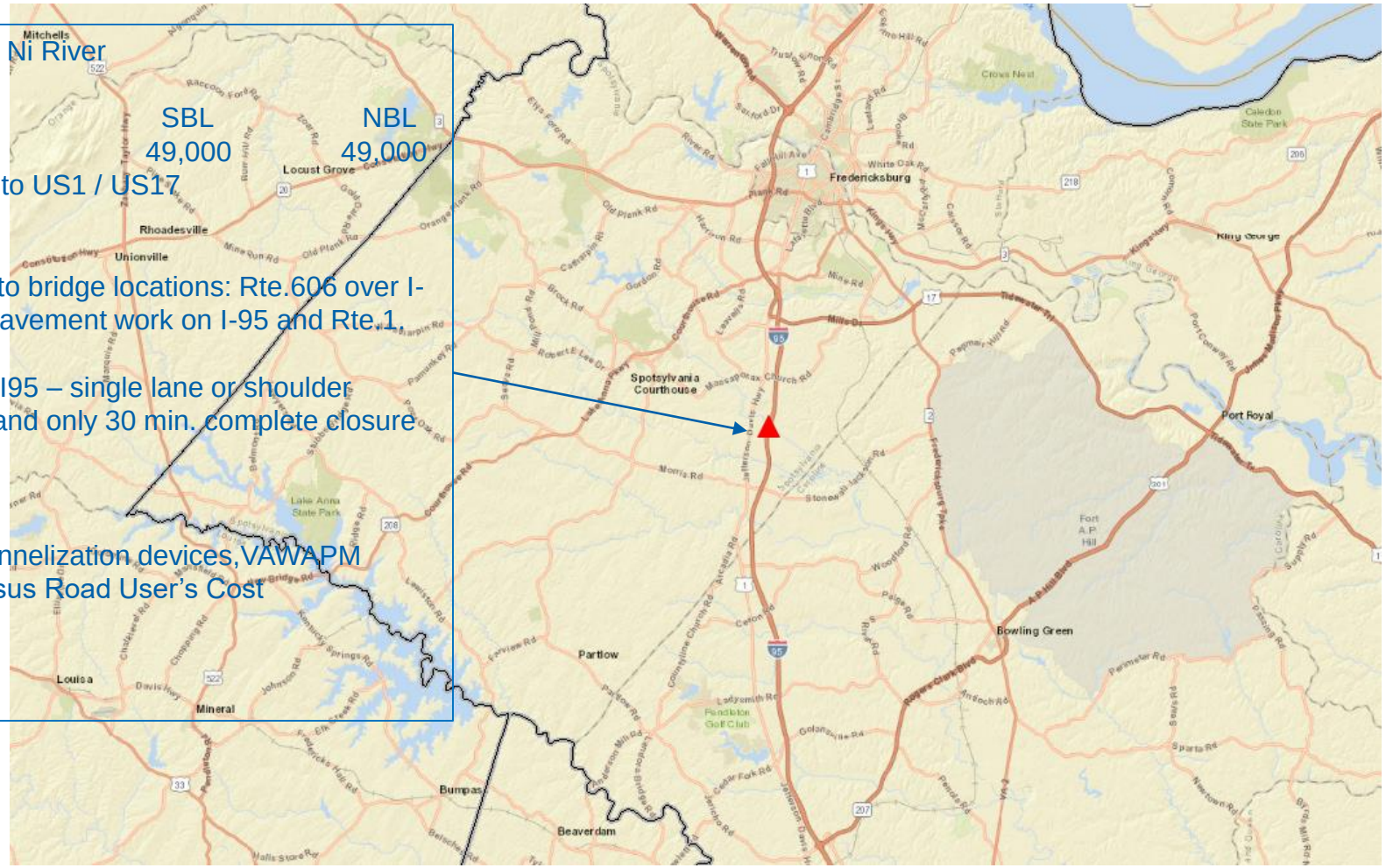
Rte. 606 (Mudd Tavern Rd.) to US1 / US17
Exit 136 to Exit 140

2.Active Contracts adjacent to bridge locations: Rte.606 over I-95 project (UPC#100829), Pavement work on I-95 and Rte.1.

3.Limitation of Operation on I95 – single lane or shoulder closures, two lane closures and only 30 min. complete closure on limited schedule.

4.Maintenance of Traffic
-Drop off/use of barriers,channelization devices,VAWAPM
-Shoulder strengthening versus Road User's Cost
-Steel bridging plates

5.Budget constraints



Construction chronology of bridges on I-95 SB & NB

Crossing	Ni River	Potomac Creek	Aquia Creek
Built (2 lanes) -SB -NB	1964 108.12’ x 44’ 108.12’ x 44’	1963 137.11’ x 44’ 142.46’ x 44’	1963 159.33’ x 44’ 159.33’ x 44’
Widening (3rd lane) -SB -NB	1988 108.12’ x 23.91’ west 108.12’ x 23.91’ east	1987 137.11’ x 25’ west 142.46’ x 19’ west	1988 159.33’ x 25.41’ west(SIP) 159.33’ x 25.41’ east(SIP)
Rehab. complete Deck patch.	2018 -SB: E.shoulder, E.lane, C.lane -NB: W.lane, C.lane	2018 -SB: E.shoulder, E.lane, C.lane -NB: E.shoulder, E.lane, C.lane	2018 -SB: E.shoulder, E.lane, C.lane -NB: W.lane, C.lane

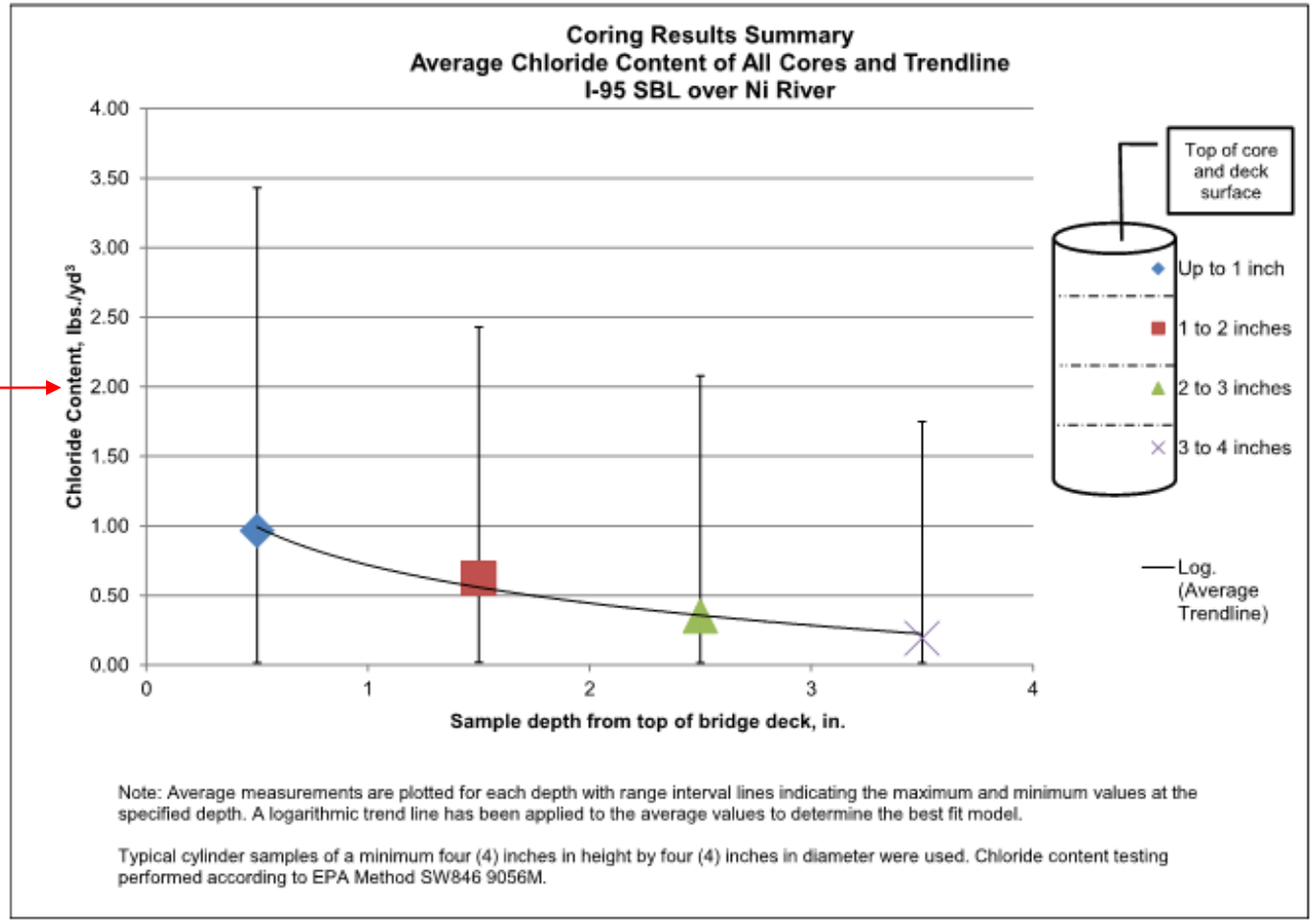
Rehabilitation Evaluation - 1

- Perform detailed visual examination and delamination marking
- Identify compromised area of deck
- Run field tests for evaluation of deck
- Compare cost of Rehabilitation to Replacement cost

Rehabilitation Evaluation - 2

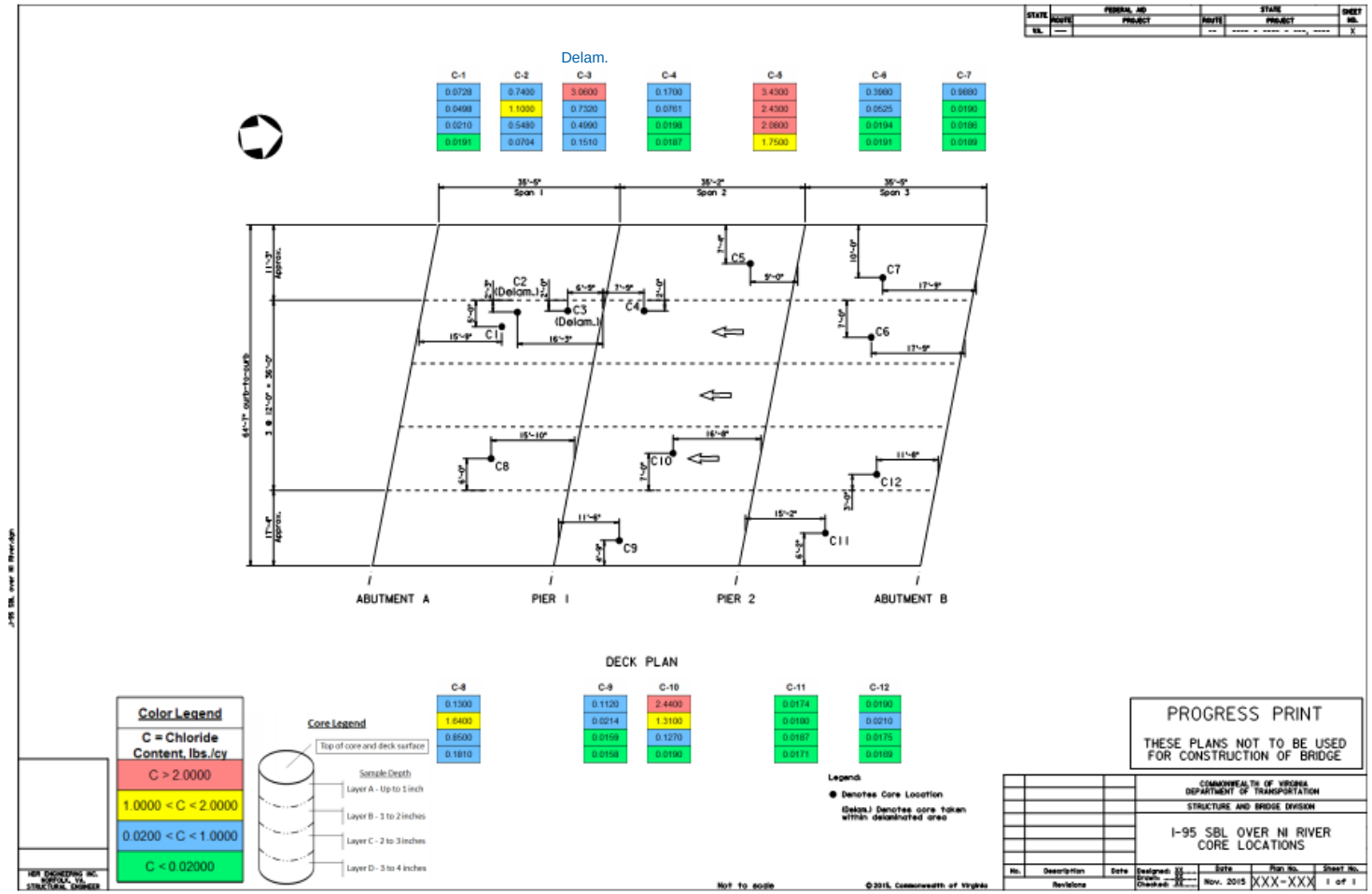
- **Coring and determining depth of chloride penetration**

Chloride content threshold = 2 lb/cu.yd.



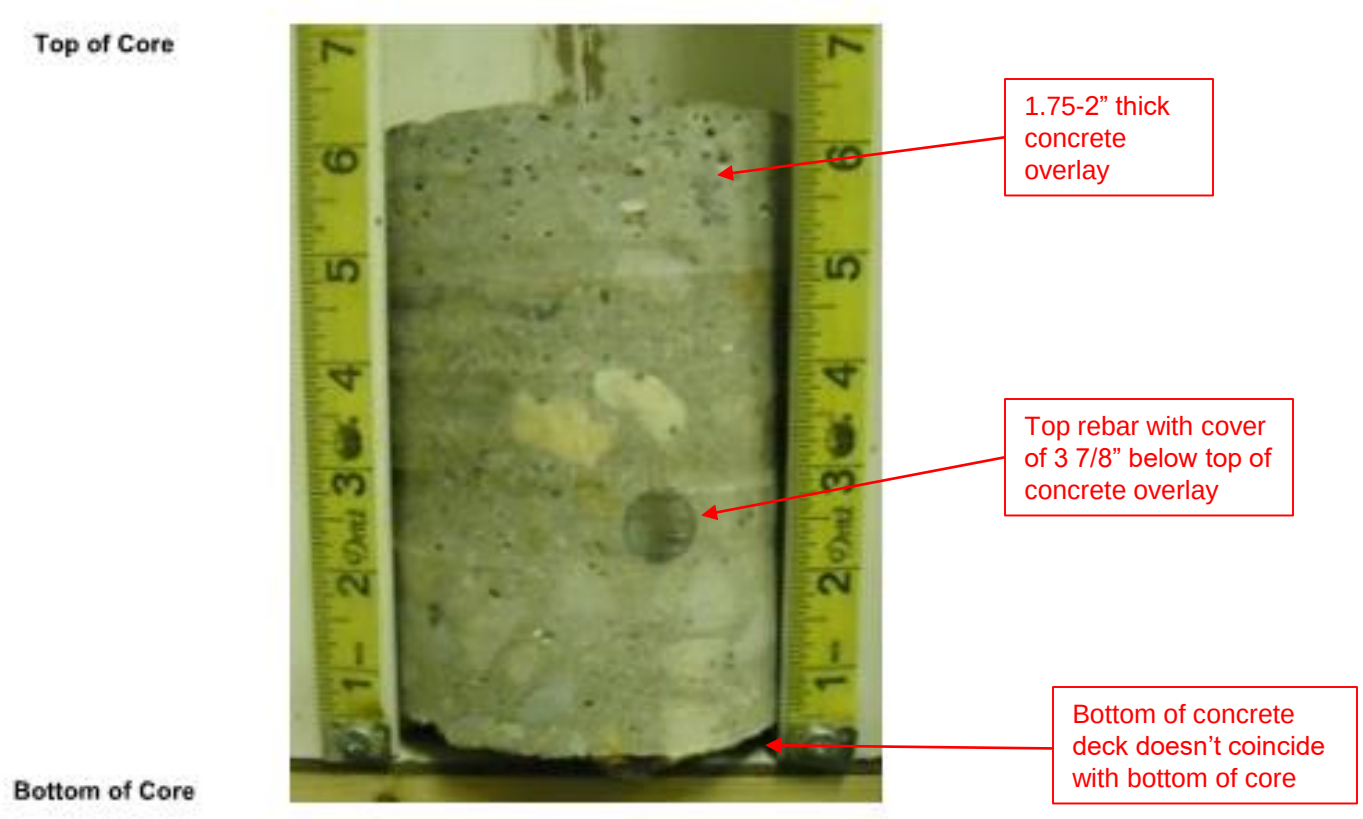
Rehabilitation Evaluation - 3

- **Identify areas of high concentration of chloride content on deck**



Rehabilitation Evaluation - 4

- **Average clear concrete cover**



Field Assessment Photos

PHOTO 4 – DELAMINATED AREA OF WEARING SURFACE LANE 1, SPAN 1, 16' FROM PIER 1

PHOTO 5 – POT HOLE PRESENT NEAR ABUTMENT B LANE 2

PHOTO 6 – UNDERSIDE OF DECK DELAMINATION IN SPAN 2, BAY 7 NEAR MID SPAN

PHOTO 7 – SPALL WITH EXPOSED REBAR IN UNDERSIDE OF DECK, SPAN 3, BAY 6 NEAR ABUTMENT B, 3'L X 1'W X 4"D

PHOTO 11 – OVER PIER 2, 12 LF OF JOINT HAS BROKEN BOND AND IS LEAKING WITH SPALLING

PHOTO 12 – 100% CORROSION ON BEARING PLATE, SPAN 2, BEAM 1 SHOWN

PHOTO 15 – SPAN 2, BEAM 4 AT PIER 1 SPALL WITH EXPOSED REBAR, 3'L X 1'H X 4"D

PHOTO 17 – SPAN 2, BAY 4 AT PIER 1 SPALL WITH EXPOSED REBAR, 60"L X 6"H X 4"D

PHOTO 19 – NUMEROUS HAIRLINE VERTICAL CRACKS WITH CHEMICAL STAINS AT ABUTMENT B, BAY 5

PHOTO 20 – PIER 1 SOUTH ELEVATION NEAR BEAM 5, 3 SF DELAMINATION NEAR TOP OF CAP WITH DEEP CRACKING

Summary of Rehabilitation Recommendations

- Mill 2 inches overlay and replace with 1.5-2 inches of LMC
- Type B and Type C patching of bridge deck
- Eliminate expansion joints at the piers
- Evaluate feasibility of deck slab extension at abutments
- Superstructure surface repairs incl. beam/diaphragm repairs
- Replace bearings
- Substructure surface repairs (piers, abutments)
- Perform load rating

I95 SBL over Potomac Cr. – Pier cap repairs

Rehabilitation Design Considerations:

- **Safety**
- **Budget**
- **Efficiency**

I95 NBL over Potomac Cr.

Limitations of Operations on I-95 – Fredericksburg District

- **Allowable time is 6.5 or 7.5 hrs. including setting MOT and removing before opening to Traffic at 4:30 AM.**

- **Seasonal difference allowing work day schedule for single-lane/shoulder closure. No allowance during summer months.**

- **Lane or shoulder closure shall be removed when a traffic back-up of greater than 7 miles is created.**

INTERSTATE 95-Allowable Lane Closure Times - September to April

Day	NORTHBOUND (Excluding Express Lanes reversible facility)		
	Single-Lane Closures or Shoulder	Two-Lane Closure	Complete Closure 30 Minute Duration (Maximum)
Monday-Thursday	12:00 AM to 4:30 AM 9:30 AM to 3:30 PM 9:00 PM to 11:59 PM	12:00 AM to 4:30 AM 10:00 PM to 11:59 PM	12:00 AM to 3:00 AM
Friday	12:00 AM to 4:30 AM 10:00 PM to 11:59 PM	12:00 AM to 4:30 AM	12:00 AM to 3:00 AM
Saturday-Sunday	12:00 AM to 7:00 AM	Not Permitted	Not Permitted

Day	SOUTHBOUND (Excluding Express Lanes reversible facility)		
	Single-Lane Closures or Shoulder	Two-Lane Closure	Complete Closure 30 Minute Duration (Maximum)
Monday-Thursday	12:00 AM to 10:00 AM 9:00 PM to 11:59 PM	12:00 AM to 4:30 AM 10:00 PM to 11:59 PM	12:00 AM to 3:00 AM
Friday	12:00 AM to 6:00 AM 10:00 PM to 11:59 PM	12:00 AM to 4:30 AM	12:00 AM to 3:00 AM
Saturday-Sunday	12:00 AM to 7:00 AM	Not Permitted	Not Permitted

INTERSTATE 95-Allowable Lane Closure Times - May to August

Day	NORTHBOUND (Excluding Express Lanes reversible facility)		
	Single-Lane Closures or Shoulder	Two-Lane Closure	Complete Closure 30 Minute Duration (Maximum)
Monday-Thursday	12:00 AM to 4:30 AM 9:00 PM to 11:59 PM	12:00 AM to 4:30 AM 10:00 PM to 11:59 PM	12:00 AM to 3:00 AM
Friday	12:00 AM to 4:30 AM 10:00 PM to 11:59 PM	12:00 AM to 4:30 AM	12:00 AM to 3:00 AM
Saturday-Sunday	12:00 AM to 5:00 AM	Not Permitted	Not Permitted

Day	SOUTHBOUND (Excluding Express Lanes reversible facility)		
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Saturday-Sunday	12:00 AM to 5:00 AM	Not Permitted	Not Permitted

Maintenance of Traffic – Rehab. on I-95 bridges

- Numerous short term lane closures for bridge rehabilitation
- Follow guidelines in VAWAPM for the use of channelizing devices / barriers
- Determine alternatives, hazards and cost compared to Road User Cost analysis
- Temporary support system to carry traffic across the joint between allowed lane closures

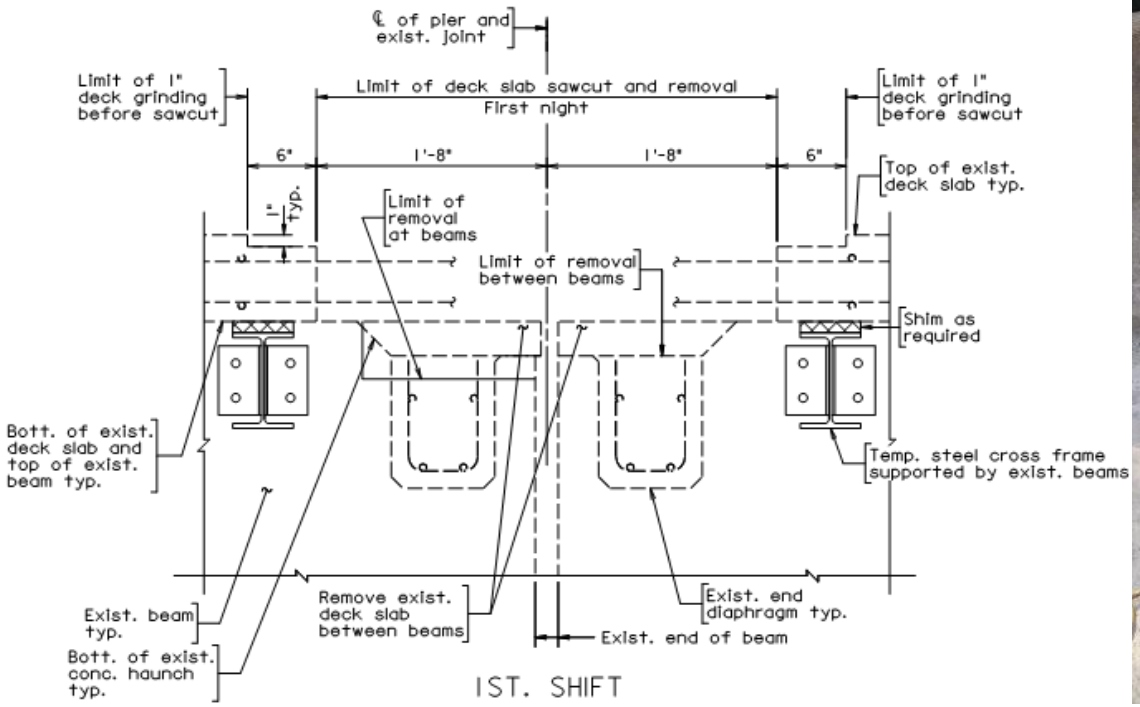
Temporary Traffic steel bridging plates (TTP) - 1

- Driving surface shall be skid resistant
- TTP shall provide a smooth transition for tires
- TTP shall meet requirements for strength and deflection
- TTP shall be securely anchored to the deck
- TTP shall bear a minimum 6 in at each end of the plate
- TTP shall be secured in place with anchor bolts spacing of 18 in
- TTP shall be regularly inspected and deficiencies corrected immediately

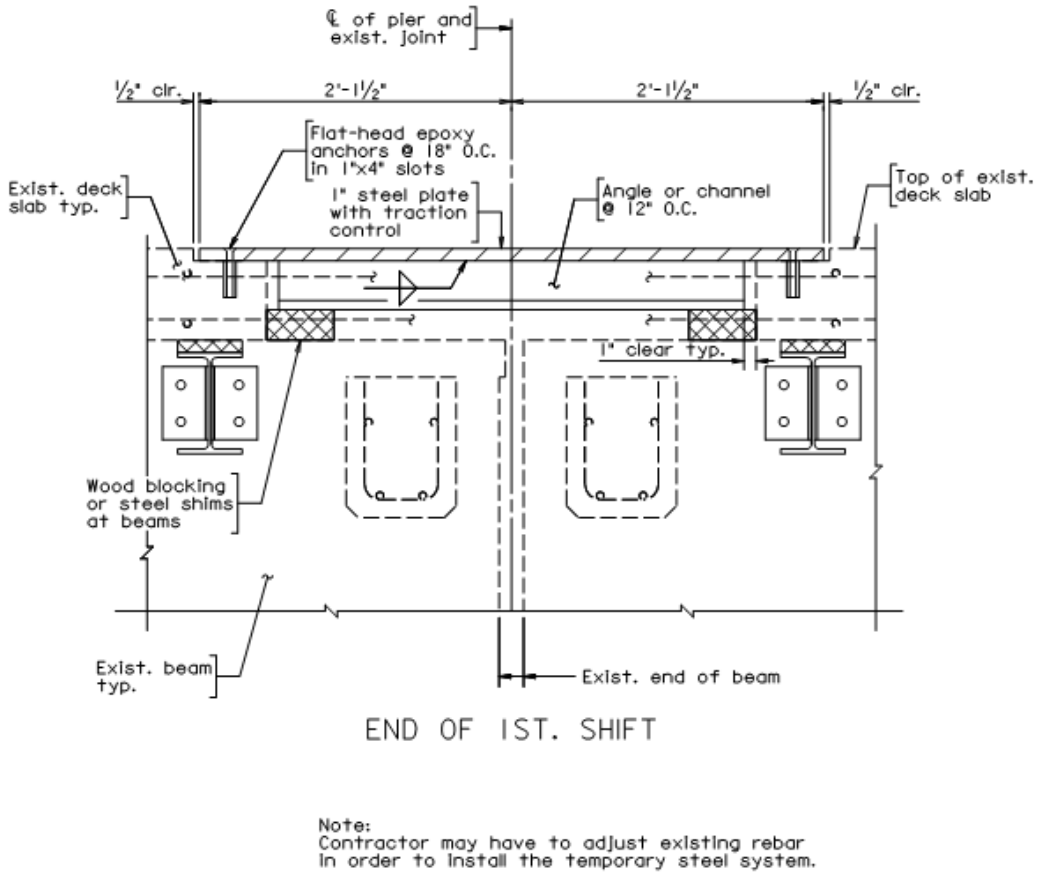
Temporary Traffic steel bridging plates (TTP) - 2

- Contractor shall provide detailed design, working drawings and calculations for Department's review
- Severe weather planning shall be considered during review of shop drawings
- TTP work sequence is planned to allow 2 work shifts to complete joint closure
- Mechanical couplers are included in the plans for the construction joints between phases
- Advance Warning signs shall be in accordance with VAWAPM

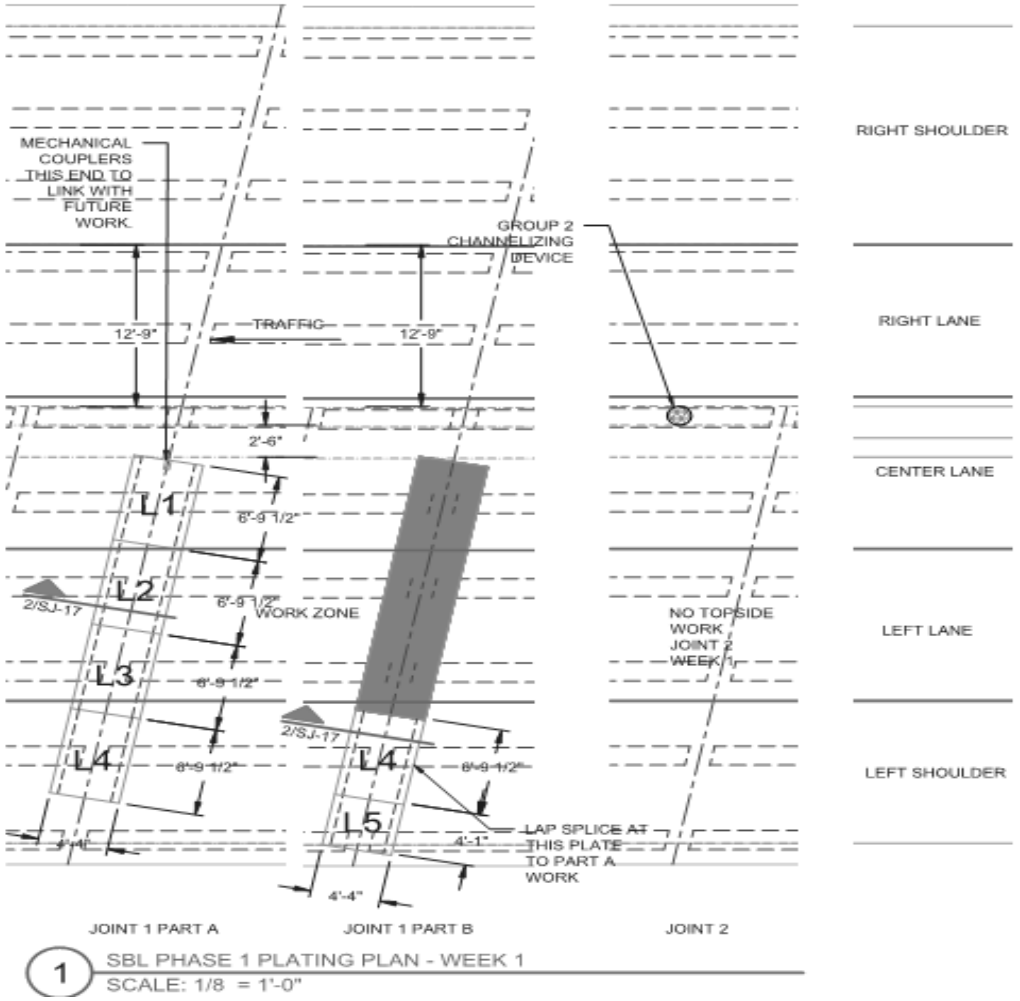
Plans for TTP - 1



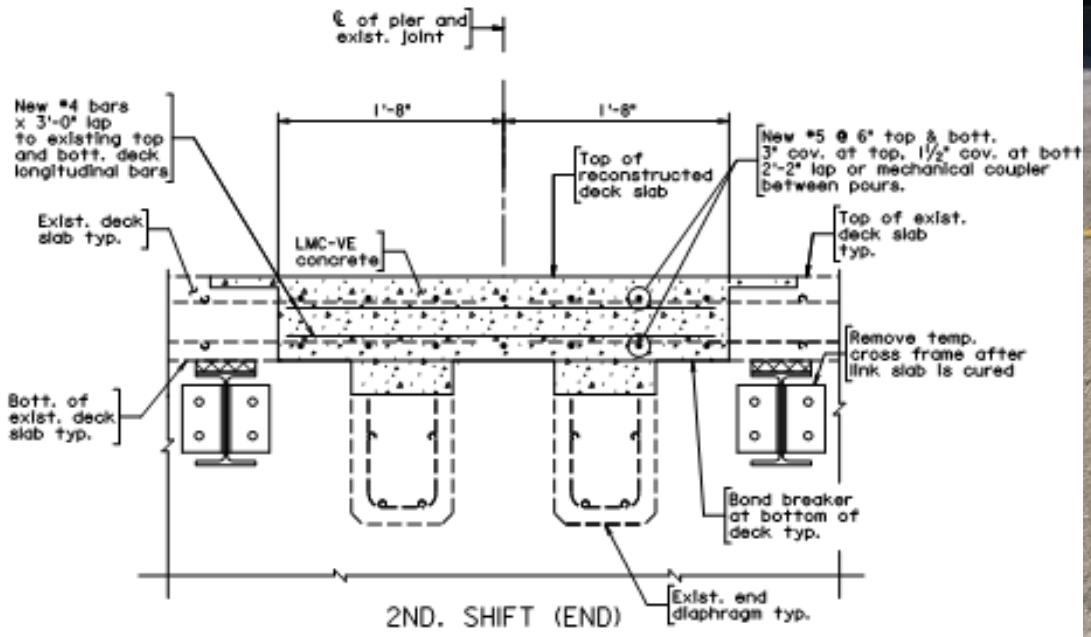
Plans for TTP - 2



Shop Dwg. for TTP - 3

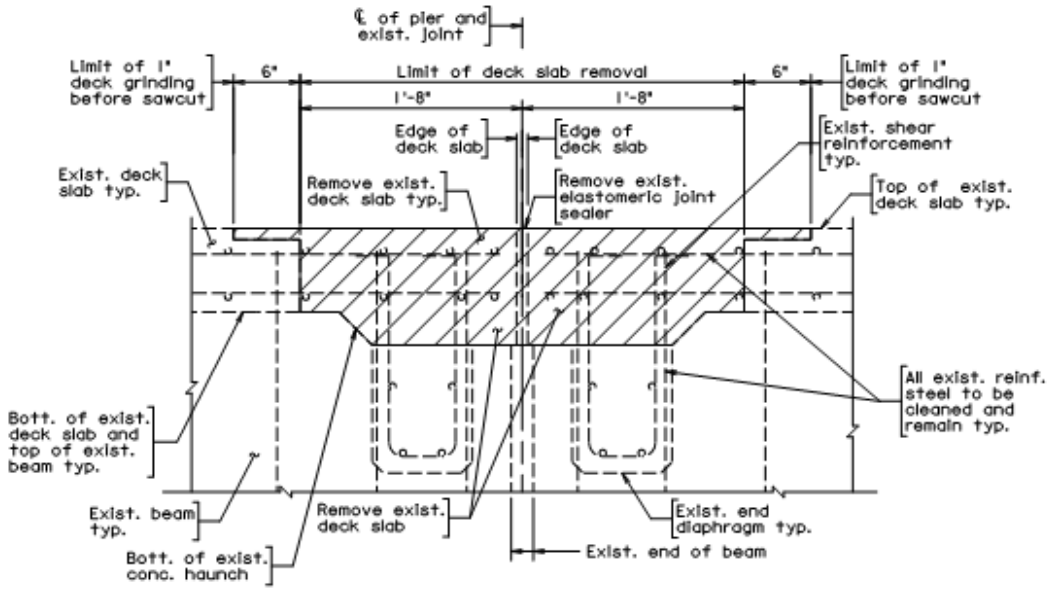


Plans for TTP - 4



Deck Closure over the piers – RC T-Beams - 1

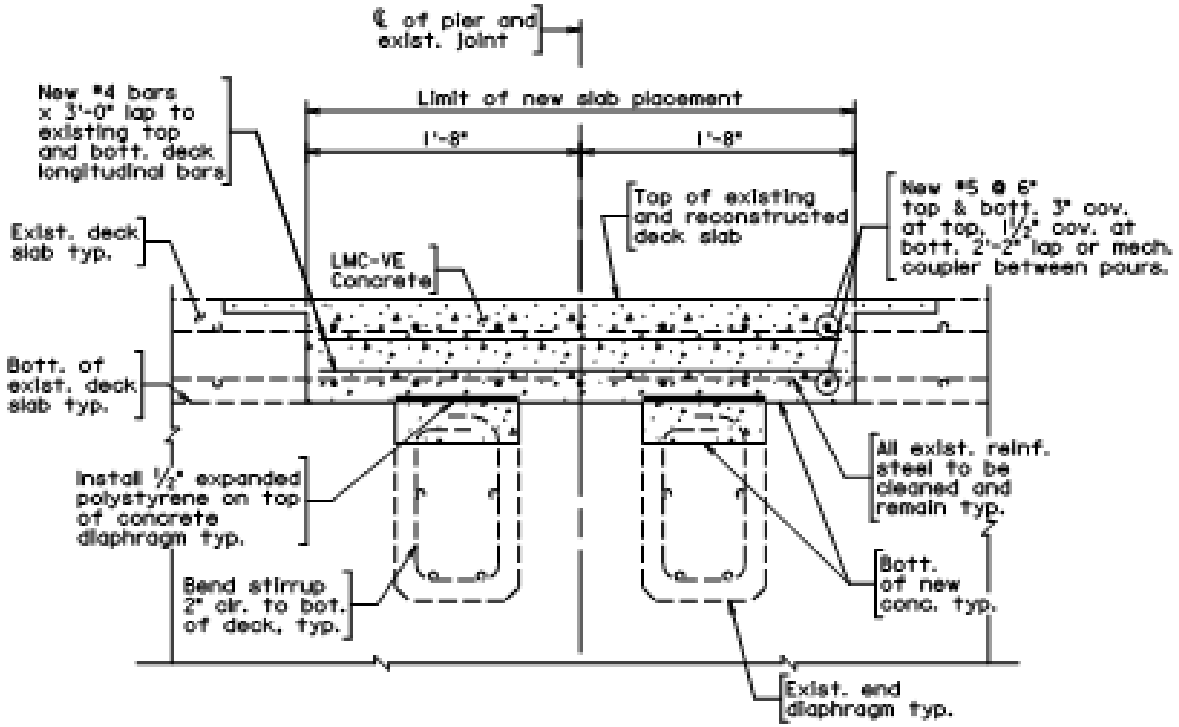
- **Joint Removal between Beams at Piers**



SECTION D-D
JOINT REMOVAL DETAILS BETWEEN BEAMS AT PIERS

Deck Closure over the piers – RC T-Beams - 2

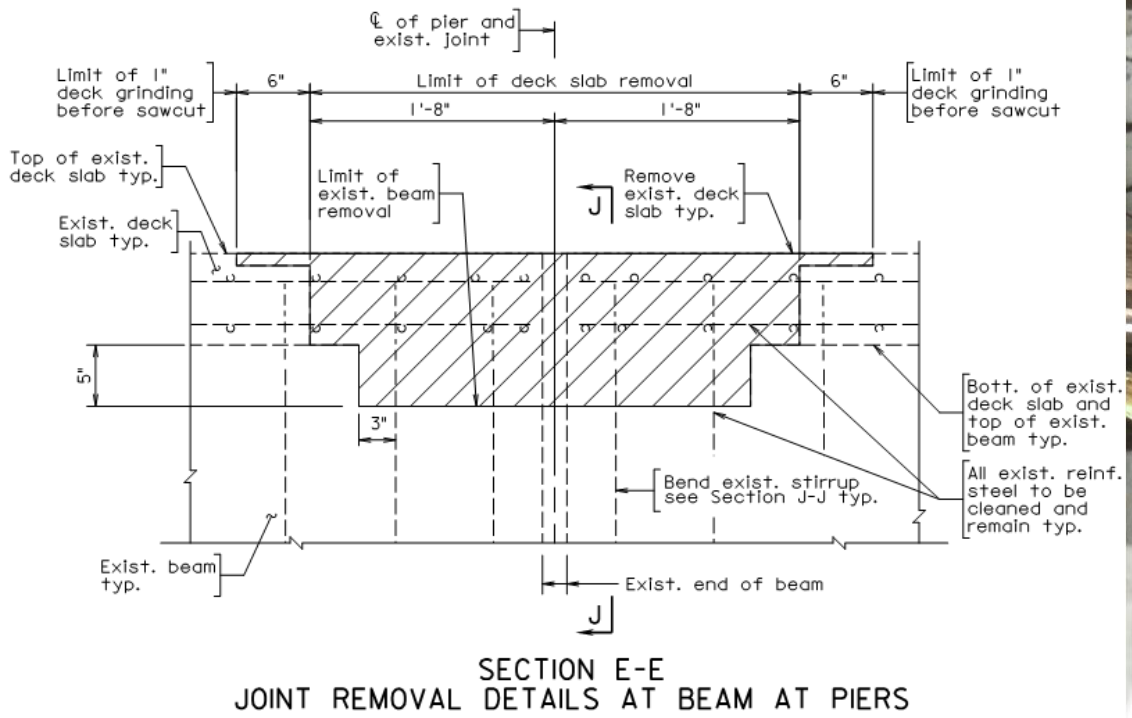
- **Joint Closure between Beams at Piers**



SECTION F-F
JOINT CLOSURE DETAILS BETWEEN BEAMS AT PIERS

Deck Closure over the piers – RC T-Beams - 3

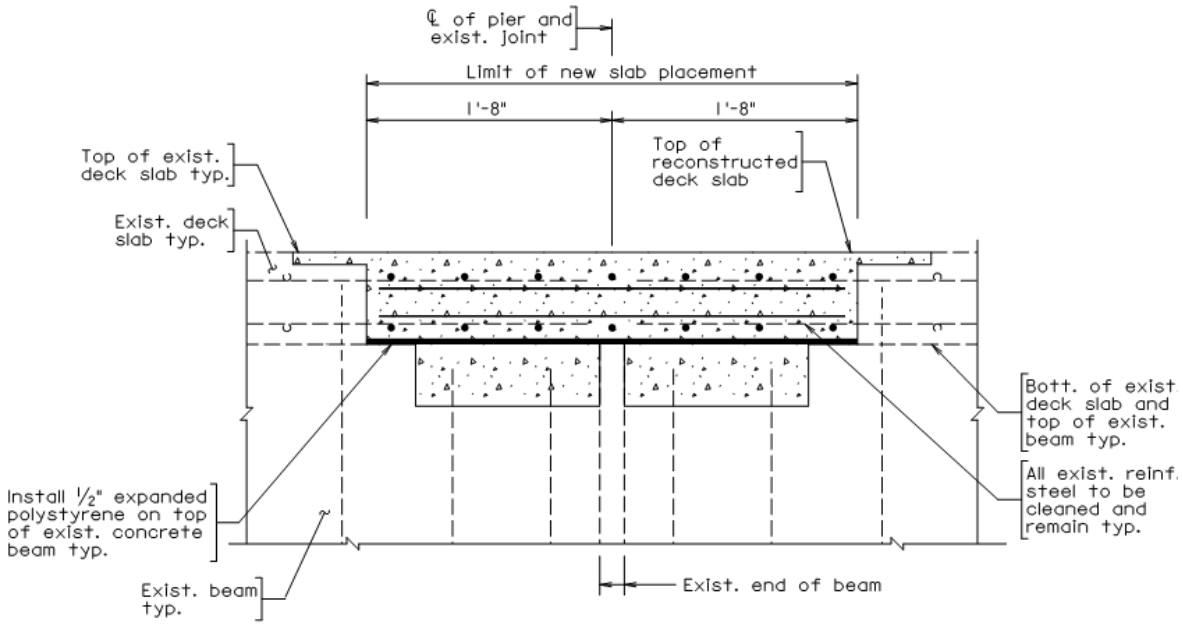
- **Joint Removal at Beams at Piers**



SECTION E-E
JOINT REMOVAL DETAILS AT BEAM AT PIERS

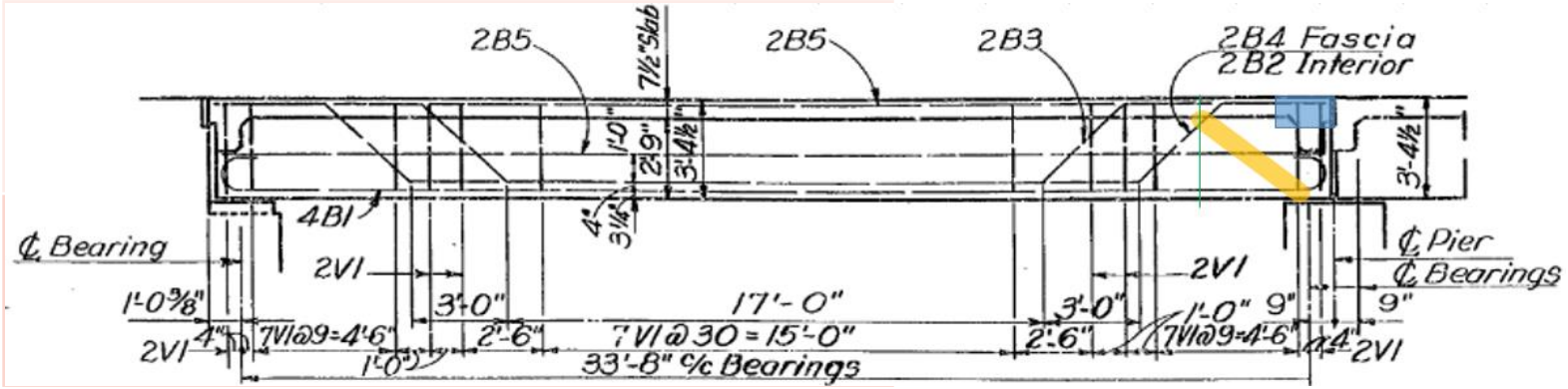
Deck Closure over the piers – RC T-Beams - 3

- **Joint Closure at Beams at Piers**



SECTION G-G
JOINT CLOSURE DETAILS AT BEAM AT PIERS

Check Shear stress at support – RC T-Beams

Temporary condition - after removing concrete portion	Permanent condition - after joint closure
-Adequate interface shear friction is developed without 1'-7" portions of the joint closure	-Interface shear friction is adequate without the 2 shear stirrups eliminated in the link slab
-No effect on cross section area channeling compressive arching action on shear-plane near support	
-Location of critical section for shear- d from internal support shift closer to internal face of support.	
-Development length of the longitudinal bent-up bars is adequate to develop their calculated tension	-Contribution of longitudinal bent-up bars in shear capacity is included.

Update of BSI report after Rehabilitation

SBL and NBL Route 95 over Aquia Creek
County: (089) Stafford

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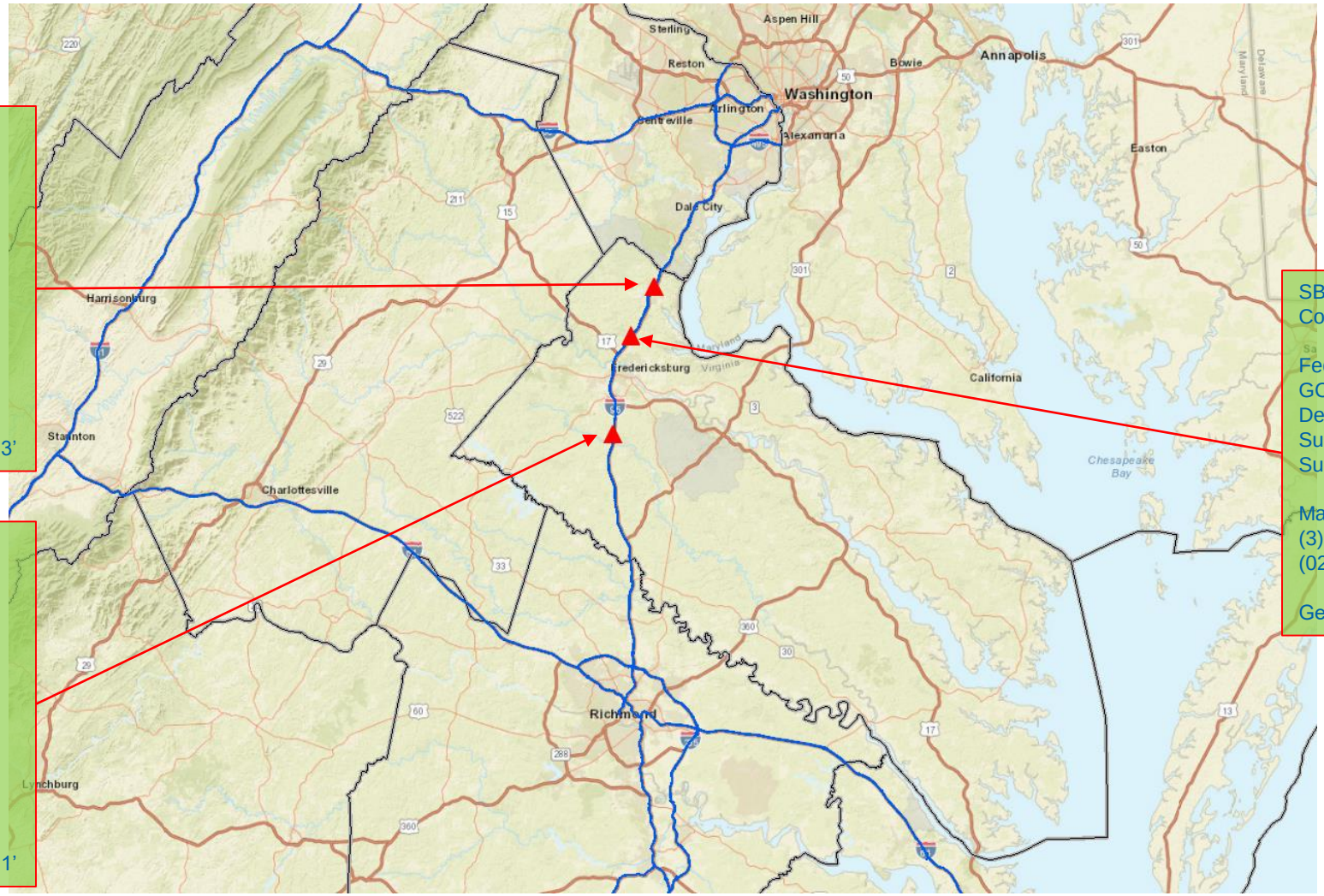

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Questions